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Does GPS decorrelation work?

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The findings of this talk are summarized as follows: (i) we propose a random simulation approach, which is the key to comparing the performances of different GPS decorrelation methods; (ii) we propose an inverse Cholesky decorrelation method, which outperforms the integer Gaussian decorrelation and the LLL algorithm; (iii) our performance study of the LLL algorithm is the first of its kind and the results have shown that the algorithm can indeed be used for decorrelation but performs worse than the integer Gaussian decorrelation and the new inverse Cholesky decorrelation; and finally, (iv) our simulations have also shown that no decorrelation techniques available up to the present can guarantee a smaller condition number, especially in the case of high dimension.

The Global Positioning System (GPS) has been widely applied in the Earth Sciences and many other disciplines. To achieve the highest accuracy that GPS can provide, one of the key issues has been the resolution of GPS carrier phase full cycle ambiguities. To speed up the ambiguity resolution and improve the confidence level of the resolved

ambiguity unknowns, the concept of GPS decorrelation has been developed and used in practice. Two major decorrelation techniques are the integer Gaussian decorrelation and the LLL algorithm. Although the former was reported to work well in practice, the following two questions remain unanswered: (i) whether it is the best decorrelation method; (ii) whether it always achieves the goal of decorrelation. The latter was only recently introduced into GPS geodesy. Very little is known about its performance of decorrelation, numerically and theoretically.

The major new results of this investigation are briefly summarized as follows: (i) we propose a random simulation approach, which is in the centre of numerically comparing the performances of different GPS decorrelation methods. The most significant advantage of the approach is that it does not depend on nor favour any particular satellite-receiver geometry and weighting system; (ii) we propose an inverse Cholesky decorrelation method, which will be shown to outperform the integer Gaussian decorrelation and the LLL algorithm, and thus indicates that the integer Gaussian decorrelation is not the best decorrelation

technique and further improvement is possible; (iii) our performance study of the LLL algorithm is the first of its kind and the results have shown that the algorithm can indeed be used for decorrelation but performs worse than the integer Gaussian decorrelation and the new inverse Cholesky decorrelation; and finally, (iv) our simulations have also shown that

no decorrelation techniques available up to the present can guarantee a smaller condition number, especially in the case of high dimension, although reducing the condition number is the goal of decorrelation.